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such attempts as those of the eminent chemist and philanthropist. The sober-minded man should encourage every form of research designed to promote the interests of humanity; but he should at the same time reserve his judgment until sufficient data are at hand for reaching a well-grounded conclusion.

The efficacy of any method of treating hydrophobia must be extremely difficult to test in a way which shall be at all conclusive. The first difficulty we meet in reaching a conclusion arises from the extreme rarity of the disease. The number of readers of these lines who have ever had personal knowledge of a case of hydrophobia is probably very small. In the returns of the last census eighty deaths are reported from this cause in the United States. But we should regard this number as an extreme limit rather than as a well-established quantity, owing to the possibility of other forms of disease being mistaken for hydrophobia. On the other hand, the number of persons who are actually bitten by dogs which, for aught they know, might have been rabid, is very great. It is certainly to be estimated by thousands, and perhaps by tens of thousands. It becomes apparently much greater when, as during the past year, the public mind is excited on the subject. In such a case it is difficult to ascertain, to the entire satisfaction of the injured person, that any dog which may have bitten him was not rabid. The result is, that it is rarely possible to select any injured person as probably being inoculated with rabies. Of the persons brought into an institute for treatment, it may be assumed that only a small percentage would, under any circumstances, develop the actual disease.

Pasteur's supposed success cannot, therefore, be established as a fact until we have more complete evidence of the circumstances attending the injuries, and especially of the rabid character of the animals which have bitten his patients. Even of the well-established cases of bites by rabid dogs, only a minority ever develop into actual rabies, and this minority may require many months for the graver symptoms to appear. The first certain conclusion must therefore be founded on statistics in which the evidence that the animal was rabid shall be conclusive, and in which every result shall be included. A table showing the termination of all cases treated, and of all similar cases not treated, will ultimately be conclusive, and nothing less will serve the purpose. The efficacy of the treatment cannot be disproved

by occasional cases of failure, unless it is shown that these cases approximate in number those in which no fatal symptoms are ever developed. This also must depend upon the results of a statistical investigation.

No doubt, a profound impression has recently been made by the failure of the treatment in the cases of the party of Russians bitten by mad wolves; but this failure only shows that the treatment may fail in such extreme cases as these, which seem to have been unusually severe. It is quite conceivable that a process which would be entirely successful in cases so mild as to require several months for their development would prove useless when the quantity of virus injected was so great as to lead speedily to a fatal termination. It is significant that the first Russian to succumb was bitten by an animal so ferocious that one of its teeth was left deeply embedded in the flesh of its victim.

If the final conclusion should be against the efficacy of inoculation, are we to denounce the propounder of the treatment as a pretender? By no means. He will still be entitled to all the credit which society owes to a man who makes an honest attempt to promote its welfare. The character of the great experimenter is above suspicion; and the knowledge which he acquires, if not useful in one direction, may be useful in another. Let us, then, wish him well, and, if he fails, let us still award him the credit due to the spirit which inspired his efforts.

THE MALARIAL GERM OF LAVERAN.

DURING a recent visit to Rome, the writer had an opportunity to see, for the first time, a most interesting blood-parasite, which was first described several years since by Laveran, a medical officer in the French army. Extended researches made in Algeria had convinced Laveran of the constant presence of this parasite in the blood of persons suffering from malarial fevers, and that it is not found in the blood of healthy persons, or in that of those suffering from other diseases; also that it disappears from the blood under the administration of quinine, which is recognized as having a specific curative effect in diseases of this class.

There are many circumstances connected with the causation of the malarial fevers which make it appear probable that they are due, either directly or indirectly, to a living organism which finds its normal habitat in marshy places, and

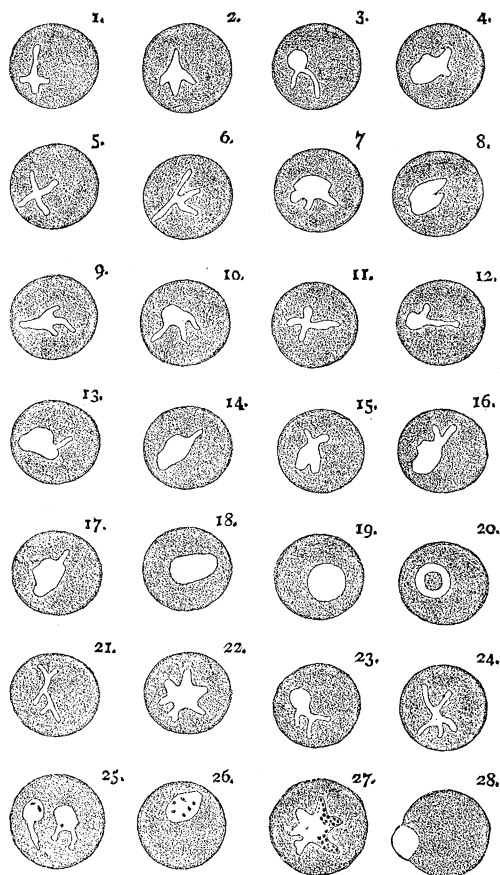
multiplies abundantly at certain seasons of the year, when conditions are favorable as to temperature, etc.

The general belief among physicians that there is a malarial germ, is, perhaps, the reason for the somewhat numerous pseudo-discoveries which have been announced. The most recent of these is the *Bacillus malariae* of Klebs and Tomassi-Crudeli. These gentlemen, in 1879, made researches in the vicinity of Rome, as a result of which they announced the discovery of a bacillus which they believed to be the veritable malarial germ. The evidence upon which their claim was based was obtained by experiments upon rabbits. The writer, in 1880, repeated their inoculation experiments with material obtained from the swamps in the vicinity of New Orleans, and showed that the fever which results from such inoculations does not correspond with the typical malarial fevers of man, and is, in fact, simply a form of septicaemia.

Nevertheless the *Bacillus malariae* received considerable credit in this country and in Europe, and many physicians were disposed to place it in the category of demonstrated disease-germs. On the other hand, the claim of Laveran received comparatively little attention. Among those who presented evidence in support of the malarial germ of Klebs and Crudeli was Professor Marchiafava of Rome. This gentleman has since continued his researches with reference to the causation of the malarial fevers, and finds himself compelled to abandon the *Bacillus malariae*. Indeed, I found no one in Rome who any longer attaches faith to this alleged discovery. But as a result of very extended observations, made in association with Dr. Celli of Rome, Marchiafava now fully confirms Laveran as to the presence of an amoeboid organism in the blood of patients suffering from malarial fever. Similar testimony had previously been given by Richard, a French army surgeon, who had excellent opportunities for such researches at Philippsville in Algeria. Space will not permit me to give a detailed account of the researches of these gentlemen, or of the different forms in which the parasite is said to present itself. The accounts show that it differs from all disease-germs heretofore discovered, inasmuch as it does not belong to the bacteria, and is not even a vegetable parasite. It is an extremely minute amoeboid organism, which is found free in the blood, or in the interior of the red blood-corpuscles (Marchiafava and Celli), or attached to them (Laveran and Richard). In a certain stage of its development it possesses from one to three or four flagella, and is endowed with active movements. But all of

the observers agree that this form is not very frequently encountered. Marchiafava and Celli only observed the flagellate organisms in four cases out of forty-two, in which the blood was carefully examined.

The accompanying figure is copied from the



FIGS. 1-20 represent the changes in form which occurred in a plasmodium, contained in a red blood-corpuscle, during a period of twenty minutes. Figs. 21-27 give some other forms which the plasmodia, both with and without pigment, may assume. Fig. 28 represents a motionless plasmodium which is emerging from a red blood-corpuscle (the blood was examined after the attack of fever and the administration of quinine).

latest paper¹ by the gentlemen last mentioned, and represents the parasite as seen in the interior of the red blood-corpuscles.

As mentioned at the outset, the writer had ocular evidence of the presence of such an amoeboid organism in the blood of a patient suffering from a malarial fever, during a recent visit to Rome. Passing through the wards of the Santo Spirito Hospital with Dr. Celli, a case was selected

¹ 'Weitere untersuchungen über die malarieinfektion,' in *Friedländer's Fortschritte der medicin*, Dec. 15, 1883.

which had not yet been subjected to medication, and in which a febrile paroxysm had just been inaugurated. A drop of blood from the patient's finger was brought directly under the microscope, and Dr. Marchiafava soon succeeded in demonstrating to me in a most satisfactory manner the presence, in several red blood-corpuscles, of the organism referred to. I saw the amoeboid movements very distinctly, and cannot doubt that the extremely minute, transparent, and apparently structureless mass which I was looking at was, in truth, a living organism.

The space at my disposal will not permit me to review the evidence in favor of the supposed causative rôle of this blood-parasite. It is evident that further researches will be required before this can be accepted as definitely settled; but I must call attention to the fact that all of the observers mentioned testify that granules of black pigment are frequently found in the interior of the parasite (figs. 26 and 27). Pathologists have long since recognized the presence of similar pigment in the blood and in various organs as a distinguishing characteristic of malarial disease; and it has been generally agreed that this pigment has, in some way, had its origin from the haemoglobin of the red blood-corpuscles. These, by some agency, are destroyed in large numbers during a malarial paroxysm. This has been proved by actual counting of the number of corpuscles in a given quantity of blood drawn before and after the paroxysms, and is made apparent by the rapidly developed anaemia which results from malarial attacks.

Marchiafava and Celli propose to call this organism *Plasmodium malariae*. Laveran has abandoned the name first suggested by him—*Oscillaria malariae*—for the reason that it might lead to the mistaken supposition that the parasite in question belongs to the Oscillatoriaceae, a family of confervoid algae: we are therefore at liberty to accept the name suggested by Marchiafava and Celli, until such time, at least, as the life-history of the parasite has been worked out, and its proper relations determined.

Finally, we may mention that Marchiafava and Celli report several cases in which they have been successful in producing characteristic attacks of malarial fever by injecting into the circulation of persons free from such disease a small amount of blood drawn from the veins of a patient suffering from a malarial attack. In these cases the presence of the blood-parasite described was verified in the blood used for the inoculation, and subsequently in the blood of the inoculated individual when he was seized with an intermittent fever as a result of such inoculation. It is also

stated that the parasite disappeared from the blood under the influence of the administration of quinine, by which the induced malarial disease was promptly cured. GEORGE M. STERNBERG.

A TRADE-ROUTE BETWEEN BOLIVIA AND THE ARGENTINE REPUBLIC.

THOUAR, whose departure for a new exploration of the Pilcomayo we have already noted, announces his safe return and successful accomplishment of the work attempted. The party, comprising twenty-three men, and two officers of the Argentine army, and a volunteer, Mr. Wilfrid Gillibert, left Fotheringham on the 5th of October, and reached the locality called El Dorado, two miles above the rapids, Nov. 12. Several encounters with the Indians had previously taken place, but here the explorers came upon a perfect ant-hill of Tobas. There were over two hundred huts, and about fifteen hundred Indians, against whom a victorious combat was waged, the Toba chief falling early in the conflict. After the fight, the explorers remained in camp on the spot for six days, minutely examining the obstructions in the river, and making canoes, with which, on the 18th of November, they started down the river, reaching the Paraguay Dec. 5, after two months of great hardship. They lost one man killed, and three disabled by wounds or dysentery.

The object of the exploration was to determine the character of the obstructions to navigation reported by Major Feilberg, and therefore the possibility of using the Pilcomayo as a commercial highway between Bolivia and the Argentine Confederation. In brief, the conclusion reached by Thouar is, that the so-called rapids are not of a serious character, being composed of soft tertiary rock, easily removed, and, even as they are, not impassable; since Father Patiño ascended them with his boats in 1721, and safely reached the borders of Bolivia. The depth of the river up to this point, at low water, averages eight feet; and beyond it, nearly five feet, with a rise in flood-time of over twenty feet. There are comparatively few snags or sand-banks. The channel, in floods, is clearly marked by the lines of high trees which border it, even when the plains beyond the channel are flooded. The channel is about thirty yards wide, and the current averages two miles an hour. Steamers of two hundred tons, drawing not over two feet and a half of water, could ascend the river to the Bolivian mission of Solano at any stage of the water. On the strength of this favorable report, an international committee has been formed, composed of Bolivian and Argentine officials, engineers and capitalists,